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REPORT ON THE SARGASSUMS

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The Sargassums of the Templeton Crocker Expedition of 1932, on the yacht *Zaca*, collected chiefly by John Thomas Howell, assist most materially in rounding out our knowledge not only of the species of this considerable and complicated group, but also of their morphological and distributional relations. The collections of marine algae of the expedition extending from Guadalupe Island on the north to the Galapagos Islands on the south, are both extensive and numerous, and this is particularly to be mentioned, since the plant collector was primarily concerned with the spermatophytic land flora.

The Sargassums of the Pacific coasts of both North and South America, and particularly of the latter, are still far from being well known. The first species of the genus to be credited to this extended area were from the coasts of Chile and were collected by D'Urville, of the corvette *La Coquille* on her voyage around the world during the years 1822 to 1825. In the botany of this voyage (pp. 119–131, published Feb. 1828), Bory de Saint Vincent enumerated and described all the Sargassums collected during the voyage and referred

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specimens collected at Concepcion, Chile, to some five separate species, to which he assigned the following names:

S. pacificum Bory
S. Esperi C. Ag.
S. granuliferum C. Ag.
S. acinaria (Turn.) C. Ag.
S. compactum Bory

J. G. Agardh, in 1847 (Nya Alger från Mexico, p. 8), named some specimens collected at St. Augustin, on the Pacific Coast of Mexico, "*S. Liebmanni*," after their collector. In 1876, Farlow (List Mar. Alg.U.S., p. 16) listed two species from western North America, under the names:

S. Agardhianum Farlow mscr. (San Diego, California)
S. piluliferum (Turn.) C. Ag. (Guadalupe Is., Mexico)

In 1886, Grunow contributed to Antonio Piccone's account of the algae of the Vettor Pisani an enumeration of the Sargassums and listed or described and figured the following species from the Galapagos Islands:

S. galapagense Grun.
S. " var. *setifolia* Grun.
S. lendigerum var. *foliosa* Grun.
S. " " " f. *subdelicatula* Grun.
S. " " " f. *rigidiuscula* Grun.
S. " " *furcifolia* Grun.
S. " " " f. *denticula* Grun.

In 1914, Marshall A. Howe (Mar. Alg. Peru, pp. 66, 67, pl. 25) treated of one species, the *S. pacificum* Bory, found among Coker's Peruvian specimens.

In 1915–1916, there was published, posthumously, the "Additamenta ad cognitionem Sargassorum" of Grunow, and the following species are credited to the west coasts of the two Americas:

S. Palmeri Grun.
S. Liebmannii J. Ag.
S. Agardhianum Farl.
S. ilicifolium var. *compacta* (Bory) Grun.
S. oocyste J. Ag.
S. pacificum Bory.
S. ambiguum var. *americana* (Sonder) Grun.
S. filiforme var.? *chilensis* Grun.
S. cymosum var. *foliosa* Grun.
S. " " " *f. subdelicatula* Grun.
S. " " " *f. rigidiuscula* Grun.
S. " " *furcifolia* Grun.
S. " " " f. *denticulata* Grun.
S. divaricatum var.? *chilensis* Grun.
S. galapagense Grun.
S. " var. *setifolia* Grun.
S. fuliginosum var. *californica* Grun.

From Grunow's revision, there are seemingly between twelve and seventeen more or less distinct species, varieties, or forms to be looked for on the Pacific coasts of North and South America.

In 1924, however, Setchell and Gardner (Proc. Calif. Acad. Sci., ser. 4, 12 (29): 731–740, 20 figs.) found among the remarkably extensive collections made in the Gulf of California by Ivan M. Johnston during the 1921 expedition of the California Academy of Sciences, some 15 species or varieties of *Sargassum*, all of which still remain seemingly distinctive of, as well as endemic to, the Gulf of California, thus indicating what is borne out by the remaining marine flora of this body of water, that it forms a "pocket" of more than ordinary distributional interest. At the close of their account, Setchell and Gardner (*loc. cit.*, 739, 740) gave a synoptical list of nineteen species or varieties known from the Pacific Coast of North America. Besides the two species of the outer coast, *S. Liebmannii* J. Ag. and *S. Palmeri* Grun., there was added *S. paniculatum* J. Ag. This last species, which was based on a determination of Th. Reinbold, seems clearly distinct from the *S. paniculatum* J. Ag. and is probably the "*S. fuliginosum* var. ? *californica* Grun." Since, however, it seems equally distinct, primarily on account of its habit and apiculate vesicles, from true *S. fuliginosum* Kuetz., actually to be regarded as a variety of *S. Henslowianum* C. Ag., it may be placed under a new combination, as follows:

Sargassum californicum (Grun.) comb. nov.

Sargassum paniculatum Setchell and Gardner, Proc. Calif. Acad. Sci., ser. 4, 12: 740, 1924, and Univ. Calif. Pub. Bot., 8 (3): 721, pl. 46, fig. 5, 1925 (non *S. paniculatum* J. Ag.). *S. fuliginosum* var. *californica* Grunow, Verh., k. k. zool.-bot. Gesell., Wien. 66: 173, 1916 (non *S. fuliginosum* Kuetz.).

In 1925, Setchell and Gardner (Univ. Calif. Pub. Bot., 8 (3): 711–721, pl. 39, fig. 46; pl. 41, fig. 55, 56; pl. 45, fig. 81; pl. 46, fig. 5; pl. 92 and pl. 94), in descriptions, figures, and key, attempted to include all information accumulated up until that time on the Sargassums of the Pacific Coast of North America.

The *Zaca* collections of Sargassums made chiefly by John Thomas Howell, as are those of the remaining marine flora, are extraordinarily ample. Those taken on, or adjacent to, the North American coast include three species, one of which seems to be undescribed, while those which were collected from the Galapagos Islands represent five species of South American affinities. The full collections from the Galapagos have presented difficulties of determination both of themselves, and because of the lack of access to the scattered authentic specimens of species already described from South America, for comparison. It seems best, because of the distinctness of each of the two assemblages, to describe the more northern group first and then the more southern, the Galapagos group.

NORTHERN SPECIES

Of the northern American group of Pacific Coast Sargassums, *S. Agardhianum* Farlow was not collected by the Templeton Crocker Expedition nor did it occur among the rather considerable collections of 1921 from the Gulf of California. It seems to be a subtropical species, confined, so far as present information goes, to the coasts of southern California and the immediately adjacent outer coast of Mexico (Ensenada, Mexico!). Nor were there any specimens of *S. californicum* (Grun.) Setchell, even in the collections from Guadalupe Island, where it is known to occur, although possibly in no great abundance. Three species, however, were collected in the northern waters: *S. Palmeri* Grun., *S. Liebmannii* J. Ag., and a species which it seems best to describe as new, thus making five species of *Sargassum*, presumably confined to the *outer* Pacific coasts of North America, with two, possibly three, of the species more subtropical and the other two more truly tropical.

1. **Sargassum Liebmannii** J. Ag. (orthogr. emend.)

Plate 28, figures 1–3

"*Sargassum Liebmanni*" J. G. Agardh, Nya Alger från Mexico, *in* Oefvers. af. Kongl. Sv. Akad. Handl., no. 1: 8, 1847, Spec. Alg., 1: 326, 1848, Spec. Sarg. Austral., 91, pl. V, 1889; De Toni, Syll. Alg., 3: 52, 1895; Grunow, Add. Cog. Sarg., 1: 398, 1915 (with var. *nicoyana* Grun.); Setchell and Gardner, Proc. Calif. Acad. Sci., ser. 4, 12: 74, 1924, Univ. Calif. Pub. Bot., 8(3): 716, pl. 45, fig. 81, 1925.

Carpacanthus Liebmanni Kuetzing, Spec. Alg., 624, 1849, Tab. Phyc., 11: 13, pl. 41, 1861.

The attachment is an irregular disk, from which arises a rather stout primary axis (up to about 1-1.5 cm. in height) which is cylindrical, but with knobs representing the bases of the fallen spirally arranged primary branches. The primary branches vary in number, length and elongation of internode, presumably according to the habitat. They may reach a length of at least 45–50 cm., with internodes up to 1.5–4 cm. long below, cylindrical and smooth, although often twisted and seemingly angulate in dried specimens. The branchlets and leaves are alternate and approximately two-ranked. The leaves vary much in length and texture, according to habitat and possibly also according to the sex-dominance of the plant bearing them. The leaves in general have distinct but usually very short petioles, vary in length up to about 4 cm., and in width up to from 4–6 mm.; their general shape is broadly to oblong lanceolate, the tip from rounded to sharply acuminate, the margins undulate to crispate, repandly spinose denticulate, and the whole leaf may be from twisted and crisped to almost flat. The costa is almost but usually not completely percurrent and rather heavy in the lower portion. The leaves of the type specimen (see pl. 28, fig. 3) are, seemingly, entirely devoid of cryptostomata and firm in texture, but the *Zaca* material shows few to fairly frequent cryptostomata, most abundant in the thinner leaves of antheridial plants and few and irregularly spaced in the thicker leaves of the oogonial plants. The vesicles are usually sparse, or even lacking in some specimens, but in some they are abundant. They are nearly spherical, with simple or compound, sharper or blunter apiculi, occasionally bicornute or even very rarely foliiferous, apparently also at times margined, 3–4 mm. in diameter, with rather stout, compressed pedicel, slightly broadened above and shorter than the vesicle. The "inflorescences" vary much in development, are in more loose or more compact, more or less flattened cymes, solitary and axillary or arranged in short terminal racemose panicles, 3–8 mm. high, dichotomous, the separate divisions separated below and stipitate, but confluent at the base above, ancipate to irregularly triquetrous, dentate above or along the whole or portions of the wings, the teeth sharp and short or long and bluntish, practically all androgynous, but varying, in the proportions of oogonial to antheridial conceptacles, usually one or the other dominant, but intermediates or "intersexes" occurring. When the receptacles are predominantly antheridial they are ancipate and toothed only at the apices; when predominantly oogonial they are triquetrous and strongly toothed along each longitudinal wing; but intermediate (or "intersex") variations and "spotwise" modifications occur. The antheridial plants are the more slender, with leaves more delicate (pl. 28, fig. 1) and with the cryptostomata more numerous.

The type locality for the species is St. Augustin (near Pochutla on the coast of Oaxaca, Mexico), whence a specimen collected by Liebmann (cotype?) is preserved in the herbarium of the University of California. Grunow (*loc. cit.*) reports a collection from the Gulf of Nicoya in Costa Rica, which he describes as "var. *nicoyana*," but which is probably an antheridial plant of quiet waters with thinner, more punctate leaves and less "spinulose" receptacles. The staff of the *Zaca* collected it off San José del Cabo, Baja, California, Mexico (*Nos. 2, 5*), at Manzanillo, Mexico (*No. 740*), both floating and brought up on the anchor of a fishing boat in Banderas Bay, Mexico (*Nos. 109* and *735 A*), at Port Parker, Costa Rica (*Nos. 107, 797* and *799*), and at Murcielago Bay, Costa Rica (*No. 951*).

Sargassum Liebmannii J. Ag. seems to be a true acanthocarpic species, with polymorphism of sexes and intersexes. It is closely related to *S. Hystrix* J. Ag., originally described from the Campeche Banks of Yucatan in the Gulf of Mexico, which seems to vary as to presence or absence of cryptostomata in a way similar to what is being discovered in *S. Liebmannii* J. Ag. *Sargassum Hystrix* J. Ag. varies into the var. *buxifolia* (Cham.) J. Ag., and probably into *S. fluitans* (Bory) Boerg., as a floating form, and possibly even into *S. natans* (L.) R. Brown. At any rate typical *S. Liebmannii* J. Ag. and typical *S. Hystrix* J. Ag. constitute a vicarious (or supplemental) pair of species, the one on the Pacific coasts of Mexico and of Central America, the other on the Gulf of Mexico coasts of Mexico, Central America, etc., the very evident closeness of the morphological characters being readily seen from J. G. Agardh's illustrations of his types (Spec. Sarg. Austral., pl. V and VIII, figs. 1–5, 1889). The existence of such a pair of species, one on one side (Pacific), the other on the other side (Atlantic) of Mexico and Central America suggests harking back to the various epochs when the Caribbean Seas were connected with the later separated Pacific waters.

2. **Sargassum Howellii** Setchell, sp. nov.

Plate 28, figures 7–10; plate 31, fig. 49

Sargassum frondibus e disco irregulari oriendis, usque ad 20 cm. altitudinem attingentibus; axi primario usque ad 9 cm. alto, 2–4 mm. crasso, infero nudo, cylindrico, sed crasse tuberculato per bases ramorum primariorum deciduorum persistentes, supero ramis primariis multifariam vestito; ramis primariis vulgo 6–10, inferis usque ad 10 cm. longis, spiraliter in axi primario oriendis, moderate congestis, suberectis, cylindricis, tuberculis basium ramorum secondorum spiraliter ornatis; foliis alternis, quoqueversum et oblique superne radiantibus, sessilibus, lanceolatis, basi abrupte, apice longe, attenuatis, apicibus obtusis, textura firma, laete fuscis usque (exsiccatis) nigrescentibus, marginibus repandis, crasse et remote denticulatis, percostatis, cryptostomatibus parvis inconspicuisque in utroque latere costae sparsis, inferis usque ad 45 mm. longis et 5 mm. latis, superioribus 20 mm. longis et 3 mm. latis; ramulis curtis, folia parva et inflorescentias ferentibus; vesiculis deuntibus; inflorescentiis axillaribus, curtis (2–5 mm. altis), receptaculis laxe usque ad dense glomerulatis, 3–4–plo dichotomis, cymosis aut, aetate provecta, racemoso-paniculatis, apicibus subacutis, comparate robustis, lente compressis, superficie inermibus, lente tuberculatis, dioicis (?) androgynis (?).

Type: No. 249,327, Herb. Calif. Acad. Sci., **Clarion Island, Revillagigedo Group,** col. *Howell No. 104,* Mar. 23, 1932.

Also Clarion Island, Revillagigedo Group, col. *Howell No. 102,* Mar. 23, 1932.

Two collections of this species were made by John Thomas Howell, the one young and sterile, the other fruiting, but both from Clarion Island in the Revillagigedo Group, from which no specimen of this genus has hitherto come to our notice (*see* Setchell and Gardner, Proc. Calif. Acad. Sci., ser. 4, 19 (11): 109–215, pl. 4–15, 1930). It is distinctly of the habit of a group centering around *Sargassum lendigerum* (L.) C. Ag. (as represented by the types of Linnaeus, well depicted by Turner, Fuci, 1:108, pl. 48, 1808). Under this group may possibly be included, not only the type plants of *S. lendigerum* from Ascension Island, collected by Osbeck, but later collections from the same island collected by J. D. Hooker in 1843 (Herb. Kew!), as well as 2 sets of specimens, also from Ascension Island, collected by Henry T. Gordon, July 1889 (Herb. Kew!). *Sargassum lendigerum* (L.) C. Ag. was also collected on Ascension Island by the *Gazelle* Expedition (*see* Grunow, *in* Askenasy, Forschungreise S.M.S. Gazelle, IV, Th.:29, 1888). To these there may be added Nos. 224 and 225 of Welwitsch's "Iter Angolense Algae" from St. Vincent Island of the Cape Verdes (Herb. Kew!). All these have the primary axis persistent (up to about 5 cm. long), with the knobs, or tubercules, representing the bases of the fallen primary branches arranged multifariously. The leaves and very short ramelli are also multifarious. The leaves are dense in consistency, costate, and with the inconspicuous cryptostomata scattered irregularly on both sides of the costa. There are no vesicles in any of these specimens although Kuetzing (Tab. Phyc., 11: pl. 19, II, 1861) in his figure of the species (based on that of Turner) has seemingly represented the small, rounded leaflets of the inflorescence as vesicles.

To *Sargassum lendigerum* (L.) C. Ag., which seems never to have been a well understood species, J. G. Agardh in 1889 (Spec. Sarg. Austral., 110) referred a Bermudan species collected by Farlow (now *S. bermudense* Grun.) and assigned it to a position near to *S. cymosum* C. Ag., but differing in cryptostomata more abundant and more conspicuous. J. G. Agardh (*loc. cit.*) says, moreover, that this later (1889) conception was not his earlier one (Spec. Alg., 1:340, 1848), which confined the species to its type locality and W. African localities (Senegambia and Teneriffe). In his earlier (1848) conception, J. G. Agardh stressed the occurrence of the cryptostomata in a single series on each side of the costa. While in the type and other seemingly definite plants of *S. lendigerum* the upper leaves show at times some approximation to such an arrangement, the "single series" is seldom a regular series, and the majority of the middle and lower leaves show the cryptostomata irregularly placed and in no definite series at all.

Apparently following the 1889 diagnosis of J. G. Agardh for *S. lendigerum*, various plants of the Caribbean Sea and adjacent regions have been assigned to *S. lendigerum* (L.) C. Ag. (*see* M. A. Howe, *in* Britton and Millspaugh, The Bahama Flora, 592, 1920). In 1889, J. G. Agardh referred certain floating plants to *S. brachycarpum* J. Ag. (which Grunow refers as a variety under *S. rigidulum* Kuetz. (Tab. Phyc., 11: pl. 27, II, 1861). The specimens from St. Thomas, Danish West Indies (now the Virgin Islands), distributed by F. Boergesen (Mar. Alg. Danish W. I., part 2, Phaeophyceae, Dansk. Botanisk Arkiv., 2 (2): 221, 1914), are probably to be referred to *Sargassum rigidulum* Kuetz. (type locality: "American tropics," probably Jamaica), rather than to *S. lendigerum* (L.) C. Ag., and it also seems to be distinct from *S. cymosum* C. Ag., as limited to type.

Finally, Grunow, in his "Additamenta" (4th installment, 139, 1916) has seemingly shown his confusion of mind by placing *S. lendigerum* of Turner as a variety under *S. cymosum* C. Ag. Now, the plant of Turner as figured on plate 48 of his Fuci and described, *is* the plant of the herbarium of Linnaeus! Grunow, however, cites under his variety *lendigerum* plants not only from Ascension Island, but also plants from Senegambia and the Canaries (as did J. G. Agardh in 1848) and even plants from St. Thomas, W. I., Port Natal, and La Guayra, Venezuela. The remarkable constitution of the *S. cymosum* of Grunow's account will come to our attention later when the *Zaca* Sargassums from the Galapagos are under discussion. For the present and for purposes of inquiring into the relationships of *S. Howellii*, it may be borne in mind that it seems best to think of *S. Howellii* as a member of an assemblage including *S. lendigerum* (L.) C. Ag. (*verum!*) and its southeastern Atlantic variants, as well as *S. rigidulum* Kuetz. and its Caribbean and west Atlantic variants.

The *Lendigerum*-group of species are first of all fairly conspicuously provided with a persistently conspicuous and more or less elongated primary axis, laterally and closely beset with the primary branches above, and tuberculoid below, with the knobs of the bases of those primary branches which have fallen. In *Sargassum lendigerum* (*verum!*) and in *S. rigidulum* Kuetz., the primary axis, even of the most mature plants known, is short as compared with that of well developed plants of *S. Howellii*. The primary branches at the tip of the primary axes have a tendency to be erect, although this is more pronounced in *S. Howellii* than in either *S. lendigerum* or *S. rigidulum*. The receptacles are cymose, more or less densely glomerulate, becoming cymosely paniculate as they grow older, the receptacular branches short and frequently dichotomous, compressed, without spines or teeth, and blunt at the crowded apices. The leaves are thickish, with a strong tendency to be opaque, sessile, percostate, and with small, obscure, scattered cryptostomata, seldom, even in the uppermost leaves, arranged strictly biseriately. Vesicles are either absent or certainly very rarely developed. The three species of the group, *S. lendigerum* (L.) C. Ag., of the southeast Atlantic, *S. rigidulum* Kuetz. of the west Atlantic and Caribbean Sea, and *S. Howellii* of the east Pacific area, are fairly close together, and *S. Howellii* possibly resembles more closely the true *S. lendigerum* than either of the two do *S. rigidulum*. *Sargassum Howellii* is of more erect habit than true *S. lendigerum*, its primary axis reaches a greater length, the leaves seem thicker and more opaque and it is widely separated in its distribution. The three species of the *Lendigerum*-group seem like vicarious multiple species or, at least, manifestations.

3. **Sargassum Palmeri** Grun.

Plate 28, figures 4–6

Sargassum Palmeri Grunow, Add. Cog. Sarg., (1), *in* Verh. k. k. zool.-bot. Gesell. Wien, 65: 338, 1915; Setchell and Gardner, Proc. Calif. Acad. Sci., ser. 4, 12: 739, 1924, Proc. Calif. Acad. Sci., ser. 4, 19: 150, 1930; Univ. Calif. Pub. Bot., 8 (3): 712, pl. 41, fig. 56, pl. 94, 1925.

Sargassum dissectifolium Setchell and Gardner, Univ. Calif. Pub. Bot., 6:386, 1917.

Sargassum piluliferum, Farlow, Rept. U.S. Fish Comm. for 1875, 706, 1877, and *in* Farlow, Anderson and Eaton, Alg. Exs. Am. Bor., 3: No. 102; J. G. Agardh, Spec. Sarg. Austral., *in* Kongl. Sv. Vet. Akad. Handl., 23 (3): 55, 1889 p. p.; Collins, *in* Collins, Holden and Setchell, Phyc. Bor. Amer., 11: No. 537, 1898, (non *Fucus pilulifer* Turner, Fuci, 1: 145, pl. 65, 1808; see also Yendo, Jour. Coll. Sci. Imp. Univ. Tokyo, 22 (12): 57, 1907).

Setchell and Gardner, in the Melanophyceae of their Marine Algae of the Pacific Coast of North America (1925), described and illustrated this species, but omitted, unfortunately, to list the localities. The species has certainly been found growing at Guadalupe Island, off the coast of Mexico, and in Avalon Bay, Santa Catalina Island. Grunow (*fide* specn.! *see* also Grunow, *loc. cit.*) collected it at Santa Cruz, California (probably floating), and other collectors have found it cast ashore at Redondo, San Pedro, Laguna Beach, La Jolla, and San Diego, California. When growing it forms masses from midlitoral down to upper sublitoral zones. The Templeton Crocker Expedition collected it at Guadalupe Island (*Nos. 103* and *551*) and at Clarion Island (*No. 355*, floating or not is not indicated).

The *Zaca* material does not add much to the already fairly extensive knowledge of the species (see Grunow, 1915, Setchell and Gardner, 1917, 1930), but a general review of all the material, especially in connection with the related species, *Sargassum galapagense* var. *setifolia* Grun., has suggested some additional points of inquiry. The plant is said to be dioecious. Grunow (1915, *loc. cit.*) apparently saw only antheridial receptacles which he describes as substipitate cylindraceous. Setchell and Gardner (1925) speak of the species as dioecious, but do not indicate definite differences between the antheridial and the oogonial receptacles. Their figure (*loc. cit.*, pl. 41, fig. 56) seems to have been taken from an antheridial plant. Both antheridial and oogonial plants occur in the *Zaca* material and the receptacles of both sexes are represented in figs. 5 and 6 on pl. 28. The oogonial receptacles are shorter and thicker than the antheridial receptacles and ovoid (broader below).

Grunow places his *Sargassum Palmeri* in J. G. Agardh's subgenus I, *Phyllotricha*, Tribe *Dimorphae*, along with *S. piluliferum* (Turn.) C. Ag. (with *phyllodes*), while he removes *S. galapagense* var.

setifolia to subgenus V. *Eusargassum*, series III, *Malacocarpicae*, Tribe *Racemosae*, and near to *S. comosum* (Poir.) Mont. (*S. Desfontainesii* Auctt.) with true leaves. Since the two last mentioned species have with *S. Palmeri* so much in common, it seems natural to place the three species in one group. This matter will be discussed later on in connection with the Galapagos plant. It may be said here, however, that the lateral members seem to be true leaves of the *Eusargassum* type, rather than phyllodes, in that they are properly horizontal and of limited growth, with inflorescences of the "*Cymosae*" type. The three species constitute, at least, a subgroup and come near to that group of *S. cymosum* Ag. variants which have a strong tendency towards pinnatifid leaves.

Southern Species

Of the South American group of Pacific Coast Sargassums, some thirteen (13) are listed, at least so far as recorded by Grunow in the Additamenta. So far as present distribution is indicated, they fall into two subgroups; the one, the more southern, described from Chile, including *S. ilicifolium* var. *compacta* (Bory) Grun., *S. oocyste* J. Ag., *S. pacificum* Bory, *S. ambiguum* var. *americana* (Sonder) Grun., *S. filiforme* var. *chilensis* Grun., and *S. divaricatum* var.? *chilensis* Grun.; the other, the more northern, thus far credited only to the Galapagos Islands, *S. cymosum* var. *foliosa* Grun., with two forms, f. *subdelicatula* Grun. and f. *rigidiuscula* Grun., *S. cymosum* var. *furcifolia* Grun., with its form *denticulata* Grun., and *S. galapagense* Grun., with its variety *setifolia* Grun. As may be seen from the foregoing enumeration, Grunow did not find (or does not recognize) any intermingling of the two groups. Of the Chilean group, *S. ilicifolium* var. *compacta* (Bory) Grunow (*S. compactum* Bory), *S. oocyste* J. Ag. (*S. Esperi* Bory, non aliorum), and *S. ambiguum* var. *americanum* (Sonder) Grun. belong, according to description, among those species in which the dominantly oogonial receptacles are spinulose or dentate. *Sargassum pacificum* Bory, *S. divaricatum* var. *chilensis* Grun. (*S. acinaria* Bory, non aliorum), *S. filiforme* var. *Chilensis* Grun., and all the Galapagos assemblage show receptacles devoid of teeth or spinules.

Perhaps it may be well to mention here the list of algae from the Galapagos Islands by W. G. Farlow (*in* B. L. Robinson, Flora of the Galapagos Islands, Proc. Amer. Acad., 38: 89–99, 1902) in which, among the collections of the "Hopkins-Stanford Expedition to the Galapagos Islands," made by Robert E. Snodgrass and Edmund Heller, he found certain specimens of *Sargassum* which he enumerated as follows:

S. cymosum Ag.
S. galapagense var. *setifolia* Grun.
?*S. graminifolium* J. Ag.

Among the comparatively abundant Galapagos specimens, collected by John Thomas Howell and other members of the expedition, careful study segregates five entities which seem worthy of specific rank. There is one striking tendency running through this group and that is the tendency to bear forked or laciniate leaves. Four of the species show these peculiar leaves in abundance; in the fifth, *Sargassum pacificum* Bory, they have been seen, but occur very rarely. Cryptostomata, too, are either entirely absent or sparse in the Galapagos species. The Galapagos species all seem to belong to the *Malacocarpicae* of J. G. Agardh, even in the restricted sense. They are also scattered through Agardh's three tribes, the *Fruticuliferae*, the *Cymosae*, and the *Racemosae*.

The three tribes of the series *Malacocarpicae*, even when that series is restricted to those members of the subgenus *Eusargassum*, whose receptacles, irrespective of the dominance of either sex, are always devoid of spines or teeth, are not to be segregated without some difficulty. The members of the *Fruticuliferae* have low, fairly compact inflorescences which tend usually towards racemose arrangement of branchlets, but both the main axis and the secondary axes should be continuous and entirely of receptacular tissue. The *Cymosae* also have low and compact inflorescences with the branches usually more or less deeply furcate and more cymose as to the individual clusters, but a terminal fertile branch or ramulus may have the inflorescences more or less closely aggregated into a sort of racemed panicle. The individual inflorescences, however, are sterile at the base with the main divisions sterile below into a stipe, but bearing forked branchlets entirely of receptacular tissue. The third tribe, the *Racemosae*, when taken in the strictest sense, have the receptacular divisions simple and each sterile-stipitate, the stipitate divisions or branches are then arranged simply racemosely, or racemosely paniculate on a sterile axis or series of axes.

There is usually a series of inflorescences in a plant, and these may more or less readily be referred to one or other of the three groups, the lowermost, or at least the lower, usually being the most characteristic, while the terminal inflorescences of the series may be modified, particularly those of the racemose-type, becoming cymose or fruticulose, or those of the cymose becoming fruticulose. Again, it seems to happen, but the instances need more study, that the dominantly antheridial receptacles may be the more characteristically fruticulose or cymose or even racemose, while the dominantly oogonial may be less characteristic and verging toward one of the other states. The following species, comprising the "southern group," as represented among the collections of Sargassum made at the Galapagos Islands, will illustrate the three groups and something of their variation in inflorescence.

4. **Sargassum zacae** Setchell, sp. nov.

Plate 29, figures 13, 14, and plate 31, fig. 50

Sargassum 36 cm. altitudinem excedens; axi primario nondum viso; ramis primariis usque ad 36 cm. altis, axi compresso folia ramulosque fertiles, moderate curtos bifariam ferente; foliis tenuiter membranaceis, laete fuscis, elongato-lanceolatis, simplicibus aut superne inaequaliter furcatis aut pinnatifidis, usque ad 5 cm. longis et 7 mm. latis, inferis longioribus, superis brevioribus, costatis, costis sub apicibus evanescentibus, marginibus undulatis, remote crasseque dentatis, apice obtuse plus minusve abrupte attenuatis, basi in petiolo curto attenuatis, cryptostomatibus vulgo paucis sparsisque; ramis secondariis comparate curtis (usque ad 5–6 cm. longis); vesiculis 1–3 mm. latis, sphericis, muticis usque ad longe apiculatis in petiolo gracili fere longiori suppositis; inflorescentiis axillaribus, 2–3 mm. longis, masculis singulis simplicibusque, usque ad cymoso-racemosis; receptaculis filiformi-lanceolato-compressis, fruticulosis, obtusis, inermibus, dioico-androgynis.

Type: No. 249,326 Herb. Calif. Acad. Sci., from **Charles Island at low tide,** *Howell Nos. 134B, 134C,* May 15, 1932.

Also Charles Island at low tide, *Howell Nos. 128, 134D, 134E,* May 15, 1932; Abemarle Island, Villamil, drift on beach, *Howell No. 133.*

Three specimens seem to answer fairly well to Grunow's description of "*Sargassum lendigerum* var. *furcifolia* forma *denticulata*" from Chatham Island (*see* Grunow, *in* Piccone, Alghe del viaggio di circumnavigazione della Vettor Pisani, 50, 1886), and strongly, but superficially, resemble the next species which, both from the description as well as from an authentic fragment, seems to be the *S. lendigerum* var. *furcifolia* of Grunow (*loc. cit.*). In his later work, Grunow (Add. Cog. Sarg., (4): 139, 1916) placed *S. lendigerum* (as to Turner's plant), as a variety, under *S. cymosum* C. Ag., as well as his var. *furcifolia* (*loc. cit.*, p. 41). As indicated earlier, the *S. lendigerum*, both of Linnaeus and of Turner, are one and the same plant (same type!), and very different from true *S. cymosum* C. Ag. The var. *furcifolia* of Grunow, however, is typically more slender, more strict, and its more delicate and more slender leaves have entire margins and are practically devoid of cryptostomata, while his forma *denticulata* is more robust, with more rigid, darker-colored leaves whose surfaces show scattered cryptostomata and whose margins are definitely denticulate. The latter is the plant here described as *Sargassum zacae*, while the former is described below as *S. Templetonii.* The two species are close, but seemingly distinct as to vegetative organs. In receptacles they are very similar, having the same sort of dimorphism in the intersexes. Those predominantly oogonial have shorter and more lax inflorescences, forked below and sterile, but the forks are made up of receptacular tissue, and are short and broadly ovate, and somewhat racemosely once or twice laterally proliferous. The inflorescences dominantly antheridial are slightly different in aspect, but constructed on the same general plan. They are forked and sterile at the base. The forks are elongated, slender, and racemosely (laterally) proliferous. The figures of *S. zacae* (pl. 29, figs. 13, 14) show both types of inflorescences, as do those of *S. Templetonii* (pl. 29, figs. 17–19).

The two species here described seem rather of Atlantic than of Pacific relationship, both as regards vegetative structure and intersex dimorphism of receptacles. *Sargassum zacae* resembles vegetatively *S. furcatum* Kuetz. (Kuetzing, Tab. Phyc., 11: pl. 32, II, 1861), unfortunately sterile, while *S. Templetonii* more closely resembles *S. ramifolium* Kuetz. (Kuetzing, *loc. cit.*, 11: pl. 32, I, 1861), which is the *S. cymosum* var. *dichotomum* Mont., (Montagne, Voy. Bonite, Bot., 41, 1844). Both these species were described from the tropical Atlantic American coasts, the former, from the Island of St. Thomas, is usually referred to *S. vulgare* C. Ag., the latter to *S. cymosum* C. Ag., two species which have similar intersex dimorphism of the receptacles and which characterizes a group of Atlantic-Caribbean-Mediterranean species such as *S. Acinarium* (L.) C. Ag. (*verum!*), *S. vulgare* C. Ag. (*verum!*), *S. cymosum* C. Ag. (*verum!*), and *S. filipendula* C. Ag. The occurrence of close relatives of these Atlantic types in the Galapagos Islands must be not only of interest, but of fundamental distributional importance and, of course, raises the question as to the propriety of considering them autonomous species. *Sargassum zacae* and *S. Templetonii* may be thought of as members of vicarious pairs of species, varieties, or forms, concerning which much more information and experience are highly desirable.

There is represented also in the Galapagos one other species of Atlantic-East Pacific affinities, and that is *Sargassum* (*galapagense* var.) *setifolia* Grun., which will be discussed later on. This plant, really an autonomous species, is closely related to both *S. Palmeri* Grun. of the California and Mexican coasts and *S. comosum* (Poir.) Mont. of the Canary Islands and adjacent coasts. In this species-group, the forking of the leaves has proceeded to a much greater extent than in the various "furcate" species of the *S. Acinarium-vulgare-filipendula-cymosum* group. In this latter group it is not always clear as to the status of the plants showing this tendency. The first of the series to be described was *Fucus diversifolius* Turner (Fuci, 2: 86, pl. 103, 1809, excl. syn. Forskål), now assigned by Grunow as a variety under *S. vulgare*, but seemingly likely to prove a form of *S. Acinarium* (*verum!*) or of *S. salicifolium* J. Ag., if this last species prove to be other than an oogonially dominant form of *S. Acinarium* (which, as usually described and figured, seems to be the antheridially dominant form). "Furcate" leaves are described under various species of *Sargassum*, either in connection with varieties, forms, or even as characteristic of the type of the species itself. As already implied, they are described as occurring at times under *S. Acinarium*, *S. vulgare*, *S. cymosum*, and *S. filipendula*. They are characteristic of *S. zacae*, *S. Templetonii*, *S. galapagense* Grun. and its var. *setifolia* Grun., *S. Palmeri* Grun., and *S. comosum* (Poir.) Mont. They are frequent in *S. polyporum* Mont. and varieties of *S. polyphyllum* J. Ag. They recall the branched "phyllodes" of the species of the subgenera *Phyllotricha* and *Schizophycus* of J. G. Agardh. While the species of the subgenera *Bactrophycus*, *Arthrophycus*, and *Eusargassum* show phyllodes or leaves normally simple, scattering species within them show, or may be expected to show "furcate" or "pinnatifid" phyllodes or leaves. Both J. G. Agardh (Alg. Medit., 41, 1842) and Montagne (Phytogr. Canar., 134, 1840, and Voy. Bonite, Bot., 42, 1844) agree in not considering pinnatifid leaved plants as constituting particular sections but as usually constituting forms or varieties of known simple-leaved species. The fact that all Sargassums of the Galapagos Islands show furcate or pinnatifid leaves gives the discussion of this topic particular interest and possible, but unexplained, significance.

5. **Sargassum Templetonii** Setchell, sp. nov.

Plate 29, figures 15–19, and plate 31, figures 51–53

Sargassum 36 cm. altitudinem multo excedens; axi primario nondum viso; ramis primariis 36 cm. et ultra longis (incompletis!), axi compresso folia ramulosque fertiles comparate curtos bifariam ferente; foliis tenui-membranaceis, pallide aut laetefuscis, elongato-lineari-lanceolatis, apice acute longe attenuatis, vulgo profunde furcato-pinnatifidis, 2.5–7 cm. longis, 1–4 mm. latis, usque ad sub apice costatis, cryptostomatibus fere nullis; vesiculis sphericis, muticis, 1–4 mm. diam., in pedicellis 2–4 mm. longis, gracilibus, suppositis; inflorescentiis axillaribus, 2–3 mm. altis, pauci-ramosis, androgynis usque ad dioicas approximantibus, masculioribus basi furcatis, furcis basi breviter stipitatis, 1–3 racemoso-proliferis cylindricis, gracilibus et frequenter plantas juveniles adhaerentes ostendentibus, inermibus, feminioribus basi-furcatis, furcis 1(–2) racemoso-proliferis, ovatis, lente compressis, inermibus.

Type: No. 249,327 Herb. Calif. Acad. Sci., **Villamil, Albemarle Island, Galapagos, in tide pools.** Col. *Howell No. 128B*, April 27, 1932.

Also Villamil, Albemarle Island, *Howell No. 134F;* floating, Wreck Bay, Chatham Island, *Howell No. 137;* Post Office Bay, Charles Island, *Howell No. 992A*, April 24, 1932.

Grunow, in his account of the Sargassums collected by Cesare Marcacci during the circumnavigation of the world by the Italian Corvette *Vettor Pisani* (*see* Piccone, Algh. de Viag. di circumnav. della Vettor Pisani, 50, 1886), described a *Sargassum lendigerum* var. *furcifolia* from Chatham Island in the Galapagos. From his description and from some fragments of his specimen in the herbarium of the University of California, it seems possible to identify certain plants of the Templeton Crocker Expedition as belonging to the same variety. Later on (1916, p. 141) he placed this variety under *S. cymosum* C. Ag., where it seems more logically located than under true *S. lendigerum* (L.) C. Ag. Although the plants may be variants of *S. cymosum* C. Ag., whose limits are as yet rather vague, the extreme discontinuity of distribution as well as certain differences in habit seem to justify considering them, for the present at least, as constituting an autonomous species.

It may be questioned as to the desirability of giving independent rank to both *Sargassum Templetonii* and *S. zacae*. Grunow considered the latter (his forma *denticulata*) to be only a form of the former (*S. lendigerum* var. *furcifolia* or *S. cymosum* var. *furcifolia*), distinguished by its broader denticulate leaves and its greater tendency to have cryptostomata, while his var. *furcifolia* (as to type) had much more slender leaves, with entire margins and practically devoid of cryptostomata. It may be that the two are ecological variants, but in the lack of more abundant series of plants of the two, it seems best, for the present, at least, to consider the two separately, the *S. zacae* tending rather toward the *S. vulgare* complex, the *S. Templetonii* towards the *S. cymosum* complex.

6. **Sargassum galapagense** Grun.

Plate 29, figures 20–27, plate 30, figures 28–30, and plate 32, figures 54–57

Sargassum galapagense Grunow was founded on a specimen (or specimens?) collected by Cesar Marcacci of the Royal Italian corvette *Vettor Pisani* in the circumnavigation of the world between the years 1882 and 1885 (*see* Grunow, *in* Piccone, Alghe Vettor Pisani, 48, pl. 1, figs. 2 and 3, 1886). The description and the brief remarks, while they give a technical idea of the species, do not touch upon some points which, in the absence of authentic specimens, would have been most helpful towards recognition of the species. Grunow (*loc. cit.*) compares it with *S. Acinarium* (in the sense of *S. Swartzii* and *S. divaricatum* Grev.), but states that it differs in its bifid, eglandulose leaves and its long apiculate vesicles. He also speaks of the leaves as rigid and blackish-brown. It seems, therefore, to be a species with thicker, denser leaves than *S. zacae* or *S. Templetonii*. It has not been reported since the original collection, for while the var. *setifolia* Grun. is mentioned by Farlow as collected by the Hopkins-Stanford Expedition, the species itself is noted only on the authority of Grunow. Grunow, possibly, had only a fragment, for he seems to have been uncertain as to whether his material was of a branch or a branchlet. The inflorescences are entirely different from those of *S. zacae* and *S. Templetonii* (*see* Grunow's figures), as they are also from those of his variety *setifolia* (*see* Grunow, *loc. cit.*, 48, 49, pl. 2, figs. 1 and 2). For this reason, which will be amplified later on, it seems best to consider the variety as a distinct species, related more nearly to *S. Palmeri* Grun. of the north than to *S. galapagense* itself.

The Templeton Crocker Expedition brought back a comparatively considerable material which seems to be closely related to, if not identical with, *Sargassum galapagense* Grun., but of which no single specimen agrees exactly with either Grunow's description or plate. Of this material only one specimen (*Howell, No. 151C*, N. E. side of Narborough Island, May 28, 1932) is provided (except exceptionally a few specimens and then only at the very tip) with bladders. This specimen (only a fragment of the uppermost portion of a plant) agrees fairly well as to axis, leaves, and receptacles with Grunow's description and figures. The bladders, however, while slightly and often sharply apiculate, do not show any of the longer setaceous projections figured by Grunow, although a few are tipped by a short spine. The vesicles, otherwise, have the general shape and the rather stout pedicel of the "Acinariae" of J. G. Agardh. The receptacles, while androgynous, are overwhelmingly oogonial in this specimen, are about 2 mm. high, in a close axillary glomerule of forked receptacular branches, each inclining away from cylindrical toward lanceolate-ovoid. They lead one to suspect that Grunow's figure 3 (*loc. cit.*, pl. 1) was drawn from an inflorescence dominantly antheridial. The inflorescence seems rather towards those of the *Cymosae* than those of the *Racemosae*, and the *Zaca* plant comes nearer to *S. divaricatum* var. *chilensis* Grun. than to any other. The var. *chilensis* was founded on the *S. acinaria* Bory (non *Fucus acinarius* L.) (*see* Bory, Voy. Coquille, Bot., 126, 1828), collected by D'Urville at Concepcion, Chile, but that has, both according to Bory and to the type specimen (in Herb. Bory, in *Herb. Mus. Paris*!) large biseriate cryptostomata. It seems fairly safe to refer *No. 151C* to *S. galapagense*, notwithstanding the minor (?) differences, and possibly as a plant of more quiet or perhaps deeper waters.

The majority of plants of the Templeton Crocker Expedition referred here to this species, seem to have come from exposed shores. They were collected at Post Office Bay, Charles Island, Galapagos, on May 17, 1932, and were evidently growing in abundance "in tide pools at the lowest tide." There is a considerable number of plants under *Nos. 385* and *969* (the one number in alcohol, the other dried), but all of the same collection. They are mostly complete plants, rather short (10 cm. to 35 cm. high), erect, of close habit, and very dark after drying. The primary axes arise singly or in clusters, range from 1 cm. up to 5 cm., covered with the multifarious knobs of the bases of the primary branches which have been lost, and bear at their tips several erect, strict, primary branches, clothed with simple or pinnatifid, thick, and rather fleshy leaves, with very short branchlets (if any) in their axils. The leaves are multifarious, closely imbricate and erect, are 1.5 cm. to 3 cm. long, according to position and as to plant. They are commonly pinnatifid (rather than properly furcate). At the tips they vary from long to short acuminate.

When moist they are rather thick and opaque, and very dark in color. When dried they seem thinner, although rigid, and show a thick, almost percurrent costa. No cryptostomata have been observed in these plants. Vesicles are wanting in the great majority of the plants, but towards the tips of a very few of the most elongated specimens a small number of small vesicles may be found, slightly longer than broad and with distinct but short setiform apicula. The receptacles are short, dense, flat-topped glomerules, cymose, with the branches slender and almost exclusively antheridial, closely resembling Grunow's figure 3 of his *S. galapagense.* It seems as if these plants from Charles Island are to be placed under *S. galapagense* Grun., as merely developmental stages or as tide-pool representatives. Grunow's plants (collected by Marcacci) were gathered on Chatham Island in March. The Narborough fragment (*Howell, No. 151C*) is probably also a plant belonging to *S. galapagense* Grun., but possibly from deeper water.

[Since writing the above account the writer has had, through the kindness and generosity of Professor Dr. Karl Keissler of the Naturhistorisches Museum at Vienna, the privilege of examining the type sheet of *Sargassum galapagense* Grun. (Coll. *Grunow, No. 701*). There are 4 larger fragments glued on to the sheet, none of which shows any basal portion. These seem to belong rather to the var. *setifolia* Grunow than to the species as described and illustrated. Leaves are not well represented, but are slender and setiform. The vesicles are rather those of the variety than those of the species and the same is true of the receptacles. There are, however, in a small envelope, four small fragments probably of a single plant, or probably a portion of a plant, which do agree with Grunow's figures in leaf, vesicle, and receptacles. These must represent the true type, the specimen from which they were separated possibly having been returned to Piccone. Comparison with these fragments of the true type fortifies the opinion that Grunow's species and variety are not so closely related as he supposed and that the plants referred above as belonging to the species are correctly assigned.]

7. **Sargassum setifolium** (Grun.) comb. nov.

Plate 28, figures 11, 12, and plate 32, figures 58, 59

Sargassum galapagense var. *setifolia* Grunow (*in* Piccone, Alghe-Vettor Pisani, 48, 49, pl. 2, figs. 1, 2, 1886); Add. Cog. Sarg., *in* Verh. k. k. zool.-bot., Gesell. Wien, 66: 167, 1916; De Toni, Syll. Alg., 3: 19, 1895; Farlow *in* B. L. Robinson, Proc. Amer. Acad., 38: 92, 1902.

Grunow seems to have experienced little doubt but that this plant, which he compares to *Sargassum teretifolium* J. Ag., a member of the *S. Swartzii* group (*Acinariae*, J. Ag., p. p.) as perhaps *S. galapagense* Grun., may well be as indicated above, was only a variant of his *S. galapagense.* J. G. Agardh (Spec. Sarg. Austral., 122, 1889) says that from the description and specimen of var. *setifolia* he had seen, he is inclined to place it near to *S. piluliferum* (in tribe *Dimorphae* of subgenus *Phyllotricha*) and does not think it closely related to either *S. acinaria* (Turn.) C. Ag., or *S. teretifolium* J. Ag. De Toni (*loc. cit.*) places both the species and the variety near to *S. comosum* (Poir.) Mont. (*S. Desfontainesii* (Turn.) C. Ag.), and Farlow (*loc. cit.*), who had only the var. *setifolia* for study, agrees with Agardh. Both J. G. Agardh and Farlow, however, were thinking of *S. piluliferum* chiefly in terms of what is now separated as *S. Palmeri* Grun. In the "Additamenta," Grunow (*loc. cit.*, 1916) places both the species and the variety along with *S. comosum* (Poir.) Mont., among the *Racemosae* of the Malacocarpic and Cladocarpic Eusargassums. There are, then, two questions concerning this plant; the one pertinent to its relationship with the type of *S. galapagense*, the other as to its relationship with other species and its consequent position within the genus *Sargassum*.

First, it seems desirable to consider the relationship of *Sargassum galapagense* Grun., type, to *S. galapagense* var. *setifolia* Grun. Grunow himself (*loc. cit.*) seems to have felt little, if any (?) doubt that the variety was a singular form of the species, in which the leaves are most narrow. The differences between the receptacles of the two, he explains by assuming that that of the species was more masculine and that of the variety more feminine. A careful examination of a considerable series of *setifolia* plants shows a remarkable uniformity in both leaf and receptacular morphology. In the species, the leaves and branchlets of the primary axis have a strong appearance (due to torsion?) of being multifarious, while *setifolia* has an equally strong appearance of being bifarious. The receptacles in the two, the variety and the species, judging both from a comparison of Grunow's figures and the fairly abundant material of the *Zaca* collections referred to each, are of entirely different types. Both are of the "dioico-androgynous" type, with dominance of one or the other sex-conceptacle. The receptacles of *S. galapagense*, both of oogonial and of antheridial dominance, form low, glomerulate inflorescences of the *Cymosae* type, the oogonial receptacles tending to be slightly compressed and also to be ovate-lanceolate, while those of antheridial dominance are more slender and torulose cylindrico-lanceolate (compare pls. 28, 29, and 30, figs. 11, 12 and 26–29). The inflorescences of *S. galapagense* resemble closely those of *S. divaricatum* Grev. (*see* Ann. & Mag. Nat. Hist., ser. 2, 3: pl. 10, 1849) and *S. Wightii* Grev. (*loc. cit.*, pl. 9). The receptacles of the var. *setifolia* are more strikingly dimorphic, and both sex dominants are distinctly racemose, with the individual receptacles, simple or slightly branched, but well separated (pl. 28, figs. 11, 12), the oogonially dominant (fig. 11) are shorter, while those of antheridial dominance (fig. 12) are elongated. A very similar difference is to be seen in the sex-differentiated receptacles of *S. Palmeri* (pl. 28, figs. 5, 6) and also of *S. comosum* (see Kuetzing, Tab. Phyc., 11: pl. 35, I, 1861, oogonial).

The vesicles, also, of the two, *Sargassum galapagense* and the var. *setifolia* are very much more different than would seem from Grunow's figures. Those of the species are rounded-oblong to slightly piriform, more or less strongly apiculate, while those of the variety are broadly fusiform with usually fairly to very long setaceous apicula. It seems that *S. galapagense* (species) is closely related to the *S. divaricatum* var. *chilense* Grun. and belongs to the *S. Swartzii*-group of species, while the var. *setifolia* forms (with *S. Palmeri* Grun. and *S. comosum* (Poir.) Mont.,) a group of species of most interesting distribution, possibly developed along the same lines as the pinnatifid forms (?) of the *S. vulgare* and *S. cymosum* groups. The erection of var. *setifolia* into an autonomous species seems reasonably justified.

Sargassum setifolium (Grun.) Setchell seems to be both abundant and widespread among the Galapagos Islands, where it appears to be endemic. The type was collected by Marcacci on Chatham Island in March. Heller and Snodgrass of the Hopkins-Stanford Expedition collected it at Tagus Cove and Turtle Point, Albemarle Island, Feb. 1899. The Templeton Crocker Expedition of 1932 brought back specimens as follows: Albemarle Island, Tagus Cove (*No. 432*, May 22, *No. 121A*, May 26, *H. W. Clark*); Villamil (*Nos. 132, 134A*, April 2, *No. 150*), Webb Cove (*No. 960*, deep water, May 2, *No. 981B*, at low tide); Indefatigable Island (*No. 128A*, Academy Bay, May 1, *No. 470*, May 1); Narborough Island, N. E. side (*No. 151B*, *No. 872*, *H. W. Clark*, May 28, *No. 800*, June 2); Charles Island, Post Office Bay (*No. 991*, April 24); Chatham Island, Wreck Bay (*No. 1011*, April 15).

8. **Sargassum pacificum** Bory (p.p.)

Plate 30, figures 31–40, and plate 33, figures 61–64

Sargassum pacificum Bory. Bory de Saint Vincent, Voy. Coquille, Bot., 123, Feb. 16, 1828; Dict. class. d'Hist. Nat., 15: 171, May 1829; Montagne, Flora Chilena (*in* Gay, Hist. fis. y polit. de Chile, Botanica, 8:)235, 236, 1852; Syll. gen. spec. Crypt., 387, 388, 1856; M. A. Howe, Algae of Peru (Mem. Torrey Bot. Club, 15:) 67, pl. 25, 1914; Grunow, Verh. zool.-bot. Gesell., Wien, 65: 438, 1915; non *S. pacificum* A. Richard, Sertum Astrolabianum, *in* Voyage de découvertes de l'Astrolabe, Bot., 142, 1834 (*S. Desvauxii* J. Ag., non *Fucus Desvauxii* Mertens, *fide* J. G. Agardh, Spec. Alg., 1: 338, 1848).

One may think of the account of the genus *Sargassum*, written by Bory for the Dictionnaire Classique, as expressing his general idea of the composition of the genus, as composed of three species (or groups of species). His first species, *S. Sargasso* Bory, included the more conspicuous floating forms and particularly the *Fucus natans* L.; his second, *S. atlanticum* Bory, typified the Atlantic forms (*S. vulgare* C. Ag.); while the third, *S. pacificum* Bory, typified the Pacific forms.

In the Voyage Coquille, he enumerated with diagnoses and descriptions some fourteen species of *Sargassum* from various oceans and seas. His *S. pacificum* is described as being based on specimens from Chile, from Tahiti, and from Port Praslin in New Ireland. There is little question, but that Bory had at least two and possibly three species referred under his *S. pacificum:* (1) Howe (*loc. cit.*) and Grunow (*loc. cit.*) have both established the species on the plants collected at Concepcion, Chile, by Dumont D'Urville; (2) the plants from Port Praslin, referred by Grunow (*loc. cit.* p. 437) to *S. oocyste* J. Ag., a species with spinulose oogonial receptacles; and (3) a specimen from Australia in Herb. Bory (seen by Grunow, Add. Cog. Sarg. (3): 34, 1916) to be referred to *S. Desvauxii* J. Ag. (non *Fucus Desvauxii* Mertens).

Bory's diagnosis (Voy. Coquille) is brief and practically without emphasis of specific characteristics, while his description indicates a plant up to two feet long, very slender, provided throughout with rather short branches not exceeding two to four inches in length at any portion from the base to the apex (primary branch); with leaves as much as one or two inches in length and two lines (about 4 mm.?) in width, irregularly dentate on the margins, very minutely glandular-punctate on the surfaces, the dots neither very easily seen, nor arranged in regular lines as in the Atlantic species (*S. vulgare*); with spherical and short-stalked vesicles, also very small, rarely exceeding in size partridge or hare shot, the whole plant becoming brown-yellow to blackish on drying.

The description of Montagne (*loc. cit.*), which was seemingly drawn up with care, has been the one usually copied and relied upon. Grunow, however, who had seen and studied the plants in Herb. Bory, states (*loc. cit.*, p. 437) that he does not venture to decide what is the true *S. pacificum* Bory, and again (*loc. cit.*, p. 438), he states that there is no specimen in Herb. Bory agreeing with the description he quotes (from Montagne). There is, however, a specimen (!) in Herb. Bory at Paris, labelled by Bory as being "*Sargassum pacificum* N." and collected by D'Urville at Concepcion, which has been taken by M. A. Howe (*loc. cit.*) for the veritable type. There is, likewise, a specimen, also in Herb. Bory, and as definitely labelled by him, but evidently collected by D'Urville on his first voyage in the *Astrolabe*, on the shores of New Guinea, which has dentate receptacles and is probably to be referred rather to the *S. Desvauxii* as understood by J. G. Agardh, although J. G. Agardh seems convinced that it is not the plant designated as *Fucus Desvauxii* by Mertens (Mém. du Mus. d'Hist. Nat., Paris, 5: 183, pl. 14, 1819). Grunow (*loc. cit.*, p. 437) has referred the New Guinea plant (inscribed also on specimen 1) to *S. oocyste* J. Ag., which, in turn, was founded (in part at least) on a specimen collected at Concepcion by D'Urville and placed by Bory (Voy. Coquille, Bot., 124, 1828) under *S. Esperi* (non *S. Esperi* C. Ag., *fide* J. G. Agardh), as well as specimens collected by Lesson at New Guinea. It seems not beyond reason to suspect that both J. G. Agardh's *S. Desvauxii* and his *S. oocyste* may be sex forms of one and the same species.

It seems most convenient to adopt the idea of M. A. Howe (*loc. cit.*) in "establishing" as the type of *Sargassum pacificum* Bory, the plant so designated by Bory and collected at Concepcion, Chile, by Dumont D'Urville in 1825. With this as a basis, the numerous plants collected by the staff of the *Zaca* in the Galapagos may be compared and placed. The type specimen is both slender and lax in habit. The plant figured by Howe (Mar. Alg. Peru, pl. 25, 1914) seems stouter and at least has the foliage much congested. Between the two are many intermediate types. It seems best to attempt segregation (although imperfect) among the lax and delicate, the more dense or rigid, and the densely congested forms, presuming that these are probably of environmental effect or reversible ecads of this wide spread and seemingly more or less plastic species.

FORMAE LAXAE

Sargassum pacificum f. **subdelicatulum** (Grun.) comb. nov.

Plate 30, figures 31–33, and plate 33, figure 61

Sargassum pacificum Bory, Voy. Coq., Bot., 123, 1828 (p. p.); *S. lendigerum* var. *foliosa* f. *subdelicatula* Grunow, *in* Piccone, Alghe-Vettor Pisani, 49, 1886; *S. cymosum* var. *foliosa* f. *subdelicatula* Grun., Verh. zool.-bot. Gesell., Wien, 66:139, 1916; *S. cymosum* Farlow, Proc. Amer. Acad., 38-92, 1902 (p. p.); *S. pacificum* M. A. Howe, Mar. Alg. Peru, 66, 1914 (as to type).

The type of *Sargassum pacificum* Bory, as established by M. A. Howe, is to be placed among the forms which Grunow has appropriately named "*subdelicatula*." Its primary axis is wanting in all the *Zaca* specimens referable to this form. The primary branches are smooth, slightly compressed below, becoming cylindrical above. The leaves tend to lie in two distinct ranks, are thin, membranaceous, light yellow-brown to somewhat darker, broad lanceolate, unequally cuneate at the base into very short, broad petioles (almost sessile), somewhat bluntly acuminate, at times almost emarginate at the tip, 1–2 cm. long, 3–4 mm. broad, costate to just below the apex, margins undulate and irregularly sinuate-dentate but basal margins entire, devoid or almost devoid of cryptostomata. The secondary branches are up to 8 cm. in length, alternate and much alike, whether basal, middle, or upper. The vesicles are spherical, smooth, muticous, 2–3 mm. in diameter, on smooth, slender pedicels, usually thickening slightly upwards, from as long as, to decidedly shorter than, the vesicles. The inflorescences are "axillary," in moderately loose to fairly dense clusters, 2–4 mm. high, short pedicellate, their receptacles dichotomo-racemose, with branches smooth, androgynous, without pronounced dimorphism as to sex dominance.

The type specimen of Bory, from Concepcion, Chile, belongs here, as do Coker's *Nos. 110* and *117* from Bay of Ferrol, Peru (see M. A. Howe, Mar. Alg. Peru, 66, 1914), and also the type of Grunow's forma *subdelicatula* from Chatham Island; likewise Snodgrass and Heller's specimens from Tagus Cove on Albemarle Island and from Wenman Island, both of December, 1898. While it is not always easy to segregate this form from the next, the following specimens collected by the Templeton Crocker Expedition may also be referred here with confidence:—Chatham Island, Wreck Bay, April 15 (*No. 138*); Charles Island, Post Office Bay, April 23 (*No. 160A*), and rocky reef of same, April 24 (*No. 992*); Indefatigable Island, Academy Bay, floating, May 1 (*No. 130*); Albemarle Island, Tagus Cove, May 26, *H. W. Clark* (*No. 120*); Narborough Island, deep tide pools, N. E. side, May 28 (*No. 151A*). The plants seem clearly those of deeper waters or at least of more quiet waters, and are in great contrast as regards texture, color, and laxness to either of the two sets of forms still to be distinguished.

FORMAE DENSIORES

Sargassum pacificum f. **rigidiusculum** (Grun.) comb. nov.

Plate 30, figure 34, and plate 33, figure 62

Sargassum lendigerum var. *foliosa* f. *rigidiuscula* Grunow, *in* Piccone, Alghe-Vettor Pisani, 49, 1886; *S. cymosum* var. *foliosa* f. *rigidiuscula* Grunow, Verh. zool.-bot., Gesell., Wien, 66: 139, 1916; *S. cymosum* Farlow, Proc. Amer. Acad., 38: 92, 1902 (p. p. fide spec'n!).

The numbers of the Templeton Crocker Expedition to be referred, with propriety, to Grunow's f. *rigidiuscula* show clearly that they grew in exposed situations and were collected from the rocks on which they grew. They are all provided with the primary axes and holdfasts, are fairly short, strict, fairly densely clothed with leaves, which are much more rigid, thicker, and cartilagino-chartaceous, as well as turning black on drying. The primary axes are up to 2 cm. high, moderately stout from an irregularly discoid holdfast, giving off primary branches multifariously. The persistent primary branches cluster at the tips of the primary axis and are of varying lengths up to 30 cm. They are clothed with leaves and (in typical forms) with extremely short (about 1 cm.) lateral branchlets, both arranged practically bifariously, but being crowded and crisped, often appear multifarious. The leaves are comparatively short (0.5–1 cm.) and broad (5 mm.), are more crisped and deeper undulate denticulate, but the unequally cuneate bases are not, in typical forms, provided with long teeth or "ciliate" curved processes. The vesicles also show only "smooth" pedicels. The inflorescences are very much like those of f. *subdelicatulum*, but rather more compact, and the receptacles are more branched. Altogether the forma *rigidiusculum* has a very distinct habit, although at times there are found intermediates between it and the f. *subdelicatulum* as well as between it and the next form to be described. It seems clearly to be an ecological variant, despite its fairly distinctive habit.

Besides the type of the variety, collected by Marcacci on Chatham Island in March, the following specimens of the Templeton Crocker Expedition seem proper of reference to it:—Charles Island, Post Office Bay, April 23 (*No. 160B*); Albemarle Island, Webb Cove, May 22 (*Nos. 329, 346, 399, 961*) and 5 miles N. E. of Webb Cove, May 22 (*No. 981C*); Narborough Island, June 22 (*No. 801*), N. E. side, May 31 (*Nos. 152B* and *874*, by *Lanier*) and "California Cove," May 28 (*No. 373*). It was also brought back from Tagus Cove, Albemarle Island, by *Heller and Snodgrass* (collected. Feb. 1899).

FORMAE CONGESTAE

Sargassum pacificum f. **congestum** Setchell f. nov.

Plate 30, figures 35–40, and plate 33, figures 63, 64

Sargassum pacificum, M. A. Howe, Mar. Alg. Peru, 66 (p. p. as to Lobos de Afuera plant), pl. 25, 1914.

A forma typica in foliis abbreviatis, crassis rigidioribusque congestis et in ramis secondariis comparate longioribus abludens; foliis vesiculisque vulgo cum dentibus curvatis basalibusque adornatis.

Type: No. 249,324 Herb. Calif. Acad. Sci., **Narborough Island, S. E. side,** collected by *J. T. Howell No. 149*, June 1, 1932.

Also Narborough Island, N. E. side, *Howell No. 873*, less typical; Albemarle Island, five miles N. E. of Webb Cove, *Howell Nos. 959, 981;* May 22, 1932; Post Office Bay, Charles Island, *Howell No. 969B*, April 23, 1932, less typical.

Also Lobos de Afuera, Peru, *Coker, No. 279* (*M. A. Howe*, loc. cit.).

The figure of M. A. Howe (*loc. cit.*) of the plant from "Lobos de Afuera," Peru, is typical of what it seems best to regard as an extreme in density of foliage and the crispness of leaves which is associated with it. The primary axis is short (about 1 cm.) and bears a number of primary branches. These are often fairly long (up to 40 cm.), and they are densely clothed with short leaves (about 0.5–1 cm.) and fairly long to very short secondary branches. The longer-branched specimens seem the more characteristic. The leaves are thick and strongly, but irregularly toothed and crispate. They commonly show a few rather long, stout and curved teeth at the very base, and this seems fairly characteristic of the form. Such teeth are also often found on the pedicels of the vesicles. The inflorescences are very much like those of f. *rigidiusculum.* The assumption of an appearance of a multifarious arrangement of leaves is usually very strong in this form.

Before leaving *Sargassum pacificum* Bory, it seems only proper to say something as to its possible relationship. The only species at all closely resembling it from the South American coast is *S. compactum* Bory (Voy. Coq., Bot., 126, 1828), which Grunow (Verh. zool.-bot. Gesell., Wien, 65: 405, 1915), after a study of the type, has referred to *S. ilicifolium* (Turn.) C. Ag. as a variety of the conduplicate-leaved group. The type of *S. compactum* (in Herb. Bory, in *Herb. Mus. Paris*!) presents a very similar appearance to certain of the longer branched forms of *S. pacificum* Bory, but the leaves (see pl. 30, figs. 41–48) (not conduplicate in the sense of double margins!), while closely resembling those of *S. pacificum*, have abundant small cryptostomata scattered over the surface and the costa disappears well below the apex. The androgynous (dominantly oogonial) receptacles are slightly compressed and denticulate above. Its type locality is Concepcion, the same as for *S. pacificum* Bory (as established by Montagne, M. A. Howe, etc.). While it seems best, for the present, to consider *S. compactum* distinct from *S. pacificum*, yet the close resemblances balanced over against the possibly minor differences, especially in the light of similar variations as to presence or absence of cryptostomata on leaves, and intersex variation, not only in receptacular morphology but also in vegetative characters, leads to association of the two species, at least in the same group, which finds its possible relationships among the "*Ilicifolia*" group of J. G. Agardh (Spec. Sarg. Austral., 37, 1889) and its nearer associates. Grunow (*loc. cit.*, 400–418, 1915), in his presentation of the *Ilicifolia*-group, calls attention to two pertinent facts: (1) that in *S. ilicifolium* (Turn.) C. Ag., both the dominantly oogonial receptacles and those dominantly antheridial, are ancipate and acutely spinose, while (*loc. cit.*, 411–412) the antheridial (dominantly?) receptacles of *S. berberifolium* J. Ag. are terete and inerm. Grunow considers that true *S. berberifolium* J. Ag., which is known only in the antheridial state, is similar to, perhaps *is* only, the antheridial plant, of *S. droserifolium* Bory and differs from *S. ilicifolium* (Turn.) C. Ag. solely in the very smooth "male" receptacles. While it is not possible, or perhaps even desirable in this place, to discuss the complexities, confusions, and possible extreme variabilities of the *Ilicifolia*-group until much more material is available and much more study of its various members is possible, the questions raised by Grunow are pertinent to any suggestion of the proper place in the genus of *Sargassum pacificum* Bory. The general habit of both the more lax and the more dense forms, the obliquity (or inequality) of the bases of the leaves, the tendency of the costa to fail to extend to the very apex, as well as the general characters of the inflorescences when taken with intersex and environmental modifications, tend towards arranging not only *S. compactum* Bory, but also *S. pacificum* Bory, with *S. ilicifolium* (Turn.) C. Ag., *S. berberifolium* J. Ag., *S. droserifolium* Bory, and others, in a polymorphous group, widespread in the tropics of the Indo-Pacific oceans and adjacent seas.

9. **Sargassum Skottsbergii** Sjöst . . (?) forma

Plate 32, figure 60

Sargassum Skottsbergii Sjöstedt, *in* Skottsberg, Nat. Hist. Juan Fernandez and Easter Is., 2, Bot., 2(3):311, fig. 105, 1924(?); "?*S. graminifolium*" Farlow, Proc. Amer. Acad., 38:92, 1902 (non *Fucus graminifolius* Turner).

It seems desirable to deal with one other set of specimens from the Galapagos, although nothing like them is to be found among the *Zaca* collections, in order that the account of the Sargassums of the Galapagos may be the more complete. Farlow (*loc. cit.*) refers to a single specimen, collected by Snodgrass and Heller, on Wenman Island. This specimen, consisting only of the upper fructiferous portion, has been divided between the Farlow Herbarium of Harvard University and the Dudley Herbarium (*No. 158509*) of Stanford University. Farlow referred it with much doubt to *Sargassum graminifolium* (Turn.) C. Ag., but it does not agree well with the type of *Fucus graminifolius* of Turner's collection at the Kew Herbarium (see Setchell, Hong Kong Nat., Suppl. No. 4:17–19, pl. 12, fig. 2 and pl. 17, 1935) either in leaves or in vesicles. The axes of the Wenman plant are compressed to complanate. The leaves (upper) are narrowly lanceolate, practically sessile, up to 4 cm. long and 3 mm. wide, with margins provided with spinulose teeth (up to 1 mm. or 1.5 mm. long), percostate, but *lacking cryptostomata*. The vesicles are spherical, muticous to blunt apiculate, 1 mm. to 1.5 mm. in diameter, borne on slender, rather long pedicels (2–4 mm. long). The individual receptacles are lanceoid-ovoid, up to 4 mm. high and 1–1.5 mm. broad, truncately rounded at the base and abruptly attenuated at the tip, usually simple but short-pedicellate and at times short-furcate above, arranged a few together in short racemose cymes about 6–8 mm. high in successive axils, androgynous, the upper third to one-half oogonial.

The placing of the material from Wenman Island can scarcely be done with any satisfaction at present. The plants are light yellowish, as if they had been growing in intense light or such as is characteristic of floating plants. The materials differ particularly from those from the type locality (Easter Island) in color and in the lack of cryptostomata in the leaves. Sjöstedt supposed that his plants were dioecious, but an examination of the type collections has indicated that the receptacles are androgynous, but with strong dominance of either oogonia or antheridia, and a dimorphism as to stoutness or slenderness and length or breadth. Floating forms from near Easter Island collected by the non-magnetic ship *Carnegie*, show a yellowish color and a tendency to be without cryptostomata. The Galapagos plants may have been floating forms (Sargasso-types?) and not growing there.

The question of adopting the designation *Sargassum Skottsbergii*, Sjöstedt's name, even for the aberrant plant of Wenman Island, is connected with the identity of two species of J. G. Agardh, *S. stenophyllum* J. Ag. (non Martius) and *S. lanceolatum* J. Ag. (non Greville). Very possibly both the *S. lanceolatum* and *S. stenophyllum* of J. G. Agardh may belong to one and the same species cycle, for the tendency seems to be that the oogonially dominant plants have more strongly toothed leaves than those of the antheridially dominant plants, since the leaves of the latter may practically be entire on the margins. The tendency of floating forms to take on a yellow color (as in the case of *S. natans* (L.) R. Brown), and to cease developing cryptostomata (which will be dealt with in another paper treating of the pleuston of the non-magnetic ship *Carnegie*) is certainly suggestive. Whether the fragments might better be referred to *S. lanceolatum* J. Ag. (1848, sed non *S. lanceolatum* Grev., 1849) or to *S. Skottsbergii* Sjöst. may remain a question involving the identity of the two species as autonomous or not. It seems very possible that they may be. It is interesting, at least, to call attention once more to the fact that the species of the Galapagos are practically without cryptostomata (excepting, of course, *S. zacae*, in which they vary from few to many).

PLATE 28

Sargassum Liebmannii J. Ag.

Fig. 1. Portion of a fructiferous ramulus of a cotype, dominantly oogonial (Herb. Univ. Calif., *No. 141,536*).

Fig. 2. Same of intermediate between type and var. *nicoyana* Grun., dominantly antheridial (Howell *No. 109*).

Fig. 3. Same of var. *nicoyana* Grun. (Howell *No. 740*), dominantly antheridial.

Sargassum Palmeri Grun.

Fig. 4. Portion of branchlet with receptacles dominantly antheridial (Guadalupe Island, Mason *No. 1*).

Fig. 5. Inflorescence from branch of same plant as figure 4, dominantly antheridial.

Fig. 6. Portion of branchlet with receptacles dominantly oogonial (from plant collected at Santa Cruz, California, by A. Grunow, Herb. Univ. Calif., *No. 231,503*).

Sargassum Howellii Setchell, sp. nov.

Fig. 7. Portion of a fructiferous ramulus of the Type No. 249,327, Herb. Cal. Acad. Sci. (Howell *No. 104*), Clarion Island, Revillagigedo Group.

Fig. 8. Similar to figure 7 (Howell *No. 104*).

Fig. 9. Inflorescences (Howell *No. 104*).

Fig. 10. Leaf (Howell *No. 104*).

Sargassum setifolium (Grun.) comb. nov.

Fig. 11. Portion of a ramulus dominantly oogonial (Howell *No. 132*).

Fig. 12. Portion of a ramulus with receptacles alternately and zonately oogonial and antheridial (Howell *No. 960*).

All figures drawn by Roy W. Donley under the direction of W. A. Setchell, and enlarged 2 diameters.

PLATE 29

Sargassum zacae Setchell, sp. nov.

Fig. 13. Portion of a branchlet, with receptacles dominantly oogonial. Type No. 249,326, Herb. Calif. Acad. Sci. (Howell *No. 134B*), Charles Island, Galapagos.

Fig. 14. Portion of a branchlet, with receptacles dominantly antheridial. No 249,326, Herb. Calif. Acad. Sci. (Howell *No. 134C*), Charles Island, Galapagos.

Sargassum Templetonii Setchell, sp. nov.

Fig. 15. Portion of middle of a primary branch with young receptacles (Howell *No. 992 A*).

Fig. 16. Upper portion of a primary branch (Howell *No. 128A*).

Fig. 17. Portion of a branchlet with receptacles dominantly oogonial (Howell *No. 128A*).

Fig. 18. Fructiferous ramulus with receptacles dominantly oogonial (Howell *No. 992A*).

Fig. 19. Fructiferous ramulus with receptacles dominantly antheridial (Howell *No. 134E*).

Sargassum galapagense Grun.

Fig. 20. Portion of a branchlet showing young vesicles (Howell *No. 151C*).

Fig. 21. Fructiferous ramulus (Howell *No. 151C*).

Fig. 22. Inflorescence (Howell *No. 151C*).

Fig. 23. Inflorescence (Howell *No. 151C*).

Fig. 24. Inflorescence (Howell *No. 151C*).

Fig. 25. Branchlet of younger, rarivesiculose plant (Howell *No. 969*).

Fig. 26. Fructiferous branchlet from same plant of same collection (Howell *No. 969*).

Fig. 27. Inflorescence (Howell *No. 969*).

All figures drawn by Roy W. Donley, under the direction of W. A. Setchell, and enlarged 2 diameters.

Plate 30

Sargassum galapagense Grun.

Fig. 28. Fructiferous ramulus (Howell *No. 151C*).

Fig. 29. Inflorescence (Howell *No. 151C*).

Fig. 30. Leaf (Howell *No. 151C*).

Sargassum pacificum Bory
forma *subdelicatulum* (Grun.) comb. nov.

Fig. 31. Portion of a branch (Howell *No. 160A*).

Fig. 32. Fructiferous ramulus (Howell *No. 138*).

Fig. 33. Portion of a branch (Howell *No. 120*).

Sargassum pacificum Bory
forma *rigidiusculum* (Grun.) comb. nov.

Fig. 34. Tip of a primary branch (Howell *No. 152B*).

Sargassum pacificum Bory
forma *congestum* Setchell, forma nov.

Fig. 35. Tip of a primary branch of Type No. 249,324, Herb. Cal. Acad. Sci. (Howell *No. 149*), Narborough Island, Galapagos.

Fig. 36. Tip of a primary branch of type.

Fig. 37. Inflorescence of type.

Fig. 38. Inflorescence of type.

Fig. 39. Vesicle of type.

Fig. 40. Portion of a sterile primary branch showing curved fimbriae at bases of leaves and vesicles (Howell *No. 992A*).

Sargassum compactum Bory

Fig. 41. Fructiferous ramulus (type in Herb. Bory, Paris).

Fig. 42–47. Leaves from type specimen.

Fig. 48. Ramulus from type specimen.

All figures drawn by Roy W. Donley, under the direction of W. A. Setchell, and enlarged 2 diameters.

Plate 31

Sargassum Howellii Setchell, sp. nov.

Fig. 49. Type of species. No. 249,325, Herb. Cal. Acad. Sci. (Howell *No. 104*), Clarion Island, Revillagigedo Group.

Sargassum zacae Setchell, sp. nov.

Fig. 50. Portion of a plant of the type material (Howell *No. 133*).

Sargassum Templetonii Setchell, sp. nov.

Fig. 51–53. Portions of the type material (Howell *No. 134*).

Photo W. C. Matthews, reduced to approximately 0.5 diameter.

Plate 32

Sargassum galapagense Grun.

Fig. 54. Portion of an ample plant with abundant vesicles (Howell *No. 151C*).

Fig. 55. Young complete, sterile plant (Howell *No. 385*).

Fig. 56. Older complete, fertile plant (Howell *No. 385*).

Fig. 57. Well elongated fertile plant, with a few small vesicles toward the apex (Howell *No. 969 A*).

Sargassum setifolium (Grun.) comb. nov.

Fig. 58. Young plant showing basal leaves (Howell *No. 432*).

Fig. 59. Upper portion of a luxuriant specimen (Howell *No. 132*).

Sargassum Skottsbergii Sjöstd.

Fig. 60. Fragment in Dudley Herbarium (*No. 158,509*) of Stanford University.

Photo. W. C. Matthews, reduced to approximately 0.5 diameter.

Plate 33

Sargassum pacificum Bory

forma *subdelicatulum* (Grun.) comb. nov.

Fig. 61. Portion of a typical plant (Howell *No. 138*).

Sargassum pacificum Bory

forma *rigidiusculum* (Grun.) comb. nov.

Fig. 62. A small characteristic plant (Howell *No. 373*).

Sargassum pacificum Bory

forma *congestum* forma nov.

Fig. 63. A plant with unusually long branches (Howell *No. 149*).

Fig. 64. A most congested primary (?) branch (Howell *No. 149*).

Photo. W. C. Matthews, reduced to approximately 0.5 diameter.